A NEW RECORD OF *TAENIA CONFUSA*, WITH ADDITIONAL NOTES ON ITS MORPHOLOGY*

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In a collection of parasitological specimens which the writer recently received from Dr. Mark F. Boyd of the Department of Bacteriology and Preventive Medicine at the University of Texas Medical School, Galveston, there was a specimen of a tapeworm which upon investigation was found to be, apparently, an example of *Taenia confusa* Ward 1895. The worm had been sent to Dr. Boyd from the medical school hospital as a specimen of *Taenia saginata,* and was given to the writer as such, without ever having been more than casually examined. Efforts are at present being made by Dr. Boyd to get some information as to the origin of the worm, but to this date these efforts have not been successful. Nothing definite can be said at present as to its origin except that the patient was probably a native of Texas.

Particular interest attaches to the occurrence of this worm, inasmuch as hitherto only two specimens of *Taenia confusa* have been recorded, both having been sent, at different times, to Dr. H. B. Ward by a physician at Lincoln, Nebraska, in 1895. During the twenty-five intervening years no further specimens have been discovered, yet the present occurrence of a specimen from an individual in Texas indicates a strong probability that the worm has existed throughout this time in the Southern part of the middle western portion of the United States in sufficient numbers to protect it against extermination. It is probable that, as in this case, it may frequently have been passed over as a specimen of *Taenia saginata.*

Although in general agreeing with the description of *Taenia confusa* as given by Guyer (1898), the present worm differs in some details, especially of measurements, though not to such an extent as to throw serious doubts on its identity. It is, however, important to note that this worm largely bridges the gap between *T. confusa* Ward 1895 and *T. bremneri* Stephens 1909. The description of the latter is very meager, but the principal difference between this species and *Taenia confusa,* as far as determined by the few segments from which Stephens wrote his description, is in the greater width of the terminal segments, and in the greater abundance and larger size of the calcareous bodies. In both these respects the present worm is

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intermediate between *T. bremneri* and *T. confusa*. According to Dr. Bremner, who sent the specimen to Stephens from northern Nigeria, "All Fullani (a Nigerian tribe) women have them, and they are got thru drinking sour milk." Since many of the American negroes originally came from Nigeria, the occurrence of this worm in the Southern United States would very readily be explained. It is, therefore, proposed that until further evidence to the contrary is obtained, *Taenia bremneri* be considered a synonym of *Taenia confusa*.

Before discussing any of the details of the present worm, a brief account of the general morphology and anatomical peculiarities of *Taenia confusa* as described by Guyer (1898) is in place. *T. confusa* is a tapeworm from 5 to 8 meters in length, consisting of from 700 to 800 proglottids, almost all of which are longer than wide. The terminal proglottids are from 27 to 35 mm. long by 3.5 to 5 mm. wide. The scolex is not certainly known. One of Ward's specimens was provided with a scolex and Ward (1897) states that this scolex was studied by him, still attached to the entire chain, under a lens, and that it was approximately the size and shape of the scolex of a Dipylidium. This head was cut off, stained, and mounted by an assistant. It proved to be so much like the head of a Dipylidium that Dr. C. W. Stiles, according to Ward, stated that it could be nothing else. Ward states that so far as he is aware there was no opportunity for it to be confused with the head of another tapeworm, but on the evidence of the improbability of a Taenia having a head so strikingly like a Dipylidium, he was unwilling to record the head as that of the worm he was studying.

The principal anatomical features of the worm, as described by Guyer, which differentiate it from other human Taeniae are the following: delicate cuticle and musculature; small sparse calcareous bodies; small testes; small shallow genital pore, with plug-like papilla nearly filling it; vagina with distinct receptaculum seminis, preceded by a short, constricted, thick-walled portion, and with cilia doubtful, and if present pointing towards the pore instead of away from it; shell gland oval, traversed by vaginal canal, and connected with uterus by separate egg canal opening into dorsal side of uterus; ovaries large, kidney shaped; vittelaria triangular, unpaired, wedging in between ovarian lobes; ripe uterus with median stem and 14 to 18 irregularly disposed and irregularly ramifying branches, with a series of finger-like branches transversely arranged across the anterior end, the eggs emptying out before disintegration of the segment; eggs oval, $30\mu \times 39\mu$, without evident pyriform apparatus.

The general morphology of the present worm agrees in most details with that of Ward's specimens as described by Guyer, the scolex not being considered. The worm here described consists of

approximately 790 segments, the great majority of which are longer than wide. The terminal segments of this worm, measuring from 25 to 33 mm. in length, are from 6 to 8 mm. in width, as compared with a width of from 3.5 to 5 mm. in Ward's specimens, and of 9 mm. in *Taenia bremneri*. The width of the segments which are past sexual maturity but not yet fully ripe increases to about 9 mm., this width being retained for a long distance in segments gradually increasing in length from 9 to 20 mm. The approximately square segments measuring 9 by 9 to 10 mm. agree with Guyer's measurements for segments 150 to 250 cm. back of the head, which are 10 mm. long by 9 to 10 mm. wide. The difference in the width of the terminal segments may very possibly be due to a difference in the state of contraction, especially inasmuch as the worm here described does not have such conspicuously flaring posterior ends on the proglottids.

There are a number of differences between this worm and Ward's specimens in the measurements of organs. Some of the larger measurements of the present worm may be partially accounted for by the fact that the measurements are for sexually mature proglottids which measure about 9 by 9 mm. and in which the uterus is already provided with branches, whereas Guyer's measurements appear to be for the organs as they appear in much smaller segments, with unbranched uterus, which he considered sexually mature, possibly relying too much on analogy with *Taenia saginata* or *Taenia solium*. The genital pore measures from 0.8 to 1.2 mm. across by 0.25 mm. in depth, thus resembling *Taenia saginata* much more closely than do Ward's specimens. The structure of the genital pore region is similar as regards the plug-like papilla which nearly fills it, and at the tip of which the cirrus opens. It differs, however, in that the vagina also opens at the tip of the plug, just posterior to the opening of the cirrus; in fact, there is a very short common opening, about 50μ in depth.

The vagina has the peculiar features described by Guyer. In this specimen the cilia are very distinct and, as suspected by Guyer, point *towards* the genital opening, instead of away from it. Just before entering the lens-shaped receptaculum seminis there is an abrupt reduction in the lumen of the vagina with a much increased thickness of the walls, as described by Guyer. It has not been possible in the new worm to trace out the egg duct from shell gland to the dorsal wall of the uterus, but the uterus does not appear to enter the shell gland directly. The vas deferens is as described by Guyer, much coiled, and ends near the middle of the segment. In a few mounted proglottids the vasa efferentia leaving the vas deferens show very clearly, particularly so in a proglottid represented in figure 1. The ovaries in proglottids in which the uterus is unbranched are

about 1.8 by 0.65 mm. and 1.3 by 0.6 mm. respectively (the segment measures 6.5 by 4.5 mm.) but the segments do not have the reproductive organs of either sex fully matured until they reach a size of approximately 9 by 9 mm., and have the uterine branches already evident. In such segments the larger of the fully developed ovaries measures 2.7 by 1.5 mm. The vitellaria vary considerably from the broad and narrow form shown in figure 1 to a short and wide triangular form as figured by Guyer; the scalloped posterior edge is a constant feature. The ripe uterus is as described by Guyer; the most salient feature is the great irregularity of the short deeply subdivided branches which frequently become constricted at the point of emergence from the main stem; the terminal twigs, on the other hand, are swollen and contiguous. There is a series of forward-projecting finger-like branches at the anterior end, and there are two or three deeply-cleft branches prolonged in a backward direction, the main stem of the uterus not extending back of the shell gland. The type of branching of the ripe uterus is reminiscent of that of *Taenia hydatigena* Pallas. The testes in the present worm measure from 105 to 125μ in diameter, as compared with 89 to 96μ according to Guyer, and 150μ in *Taenia saginata*. A few testes near the junction of the vasa efferentia with the vas deferens are greatly enlarged, and may be 195μ in diameter, as shown in figure 1.

The uterine eggs of the present worm are approximately the size and shape reported by Guyer for Ward's specimens, though the majority are a little larger (33 by 42μ). There is a distinct pyriform apparatus in the form of two short filaments attached to the thin outer shell as shown in figure 2.

The scolex is the most interesting part of the worm here described. Although the scolex was attached to only a small portion of the body of the worm, there seems to be no reason for doubting that the head really belongs to the worm here described. There are no segments of any other worm associated with this one to indicate a double infection, and the breadth of the neck attached to the head is the same as that of the smallest section of the proglottids. Moreover, the head, although unquestionably a Taeniid head, is quite different from that of any other human species of tapeworm. It does not in any way resemble the head of *Dipylidium*.

The scolex is unarmed, and is very sharply demarcated from the neck, as will be seen by reference to figure 3. It is decidedly oblong in shape and has the suckers grouped into a pair on each side.

As stated at the beginning of this paper, in spite of certain discrepancies in measurements between this worm and those described

by Guyer, the anatomical features which this worm has in common with *Taenia confusa* leave little room for doubt that it should be referred to that species.

If, when *Taenia bremneri* becomes better known, it shall prove to be identical with *Taenia confusa,* as there appears every reason to believe is the case, judging from our present meager knowledge of it, there will be little room for doubt but that *Taenia confusa,* like *Necator americanus,* and other noxious parasites, was brought to America from Africa with the slaves.

BIBLIOGRAPHY

Guyer, M. F. 1898.—On the Structure of *Taenia confusa.* Zool. Jahrb., Syst., 11:469-492.

Stephens, J. W. W. 1908.—Two New Human Cestodes and a New Linguatulid. Ann. Trop. Med. and Parasit., 1:549-556.

Ward, H. B. 1896.—Report of the Zoologist, Ann. Report Nebraska State Bd. Agr. for 1895, 257-272.

1896.—A New Human Tapeworm. West. Med. Rev., 1:35-36. Copied in Amer. Monthly Micr. Jour., 18:305-307.
for 1896, 173-189.

1897.—Note on *Taenia confusa.* Zool. Anz., 20:321-322.

1897.—Report of the Zoologist. Ann. Report Nebraska. State Bd. of Agr.

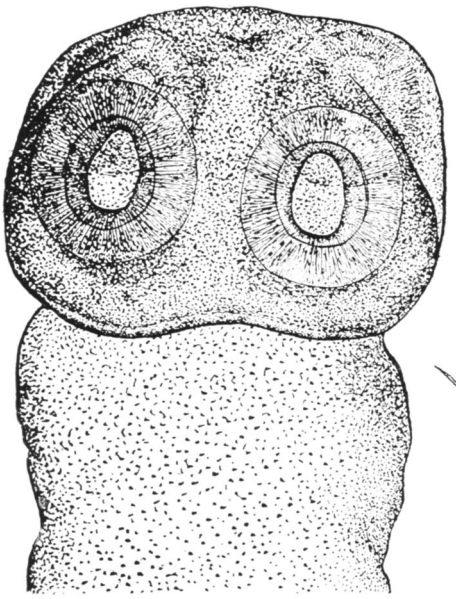
Explanation of Plate VIII

Fig. 1.—Proglottid of *Taenia confusa,* a little past sexual maturity, showing general arrangement of organs, except uterus, which is very indistinct in this proglottid. Note very distinct vasa efferentia, and enlarged deep staining testes near the end of the vas deferens. × 7.

Fig. 2.—Uterine eggs of *Taenia confusa.* × 500.

Fig. 3.—Scolex of *Taenia confusa,* viewed on broad face. × 50.

Fig. 4.—Scolex of *Taenia confusa,* as viewed from anterior end to show oblong shape, and bilateral arrangement of suckers. × 30.



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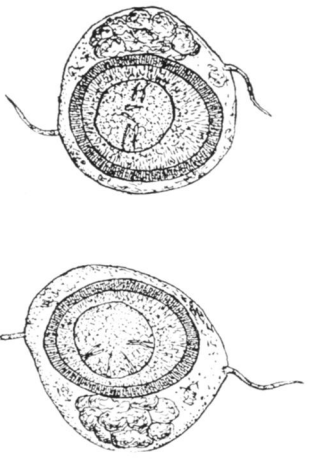

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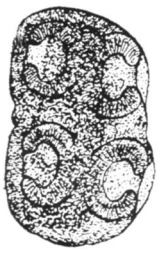

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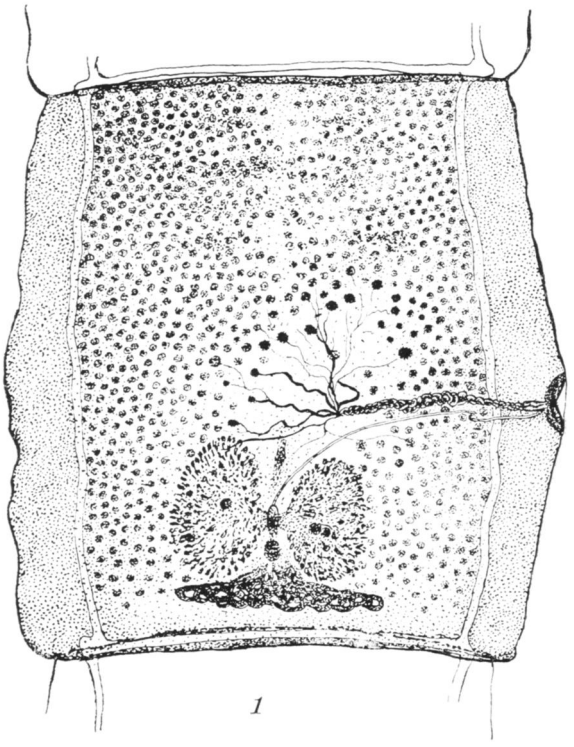

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PLATE VIII